Understanding Risk

Probability – The chance of something happening, usually expressed as a fraction or percent. There is never a 0% chance (will never happen) or 100% chance (guaranteed to happen) when we are talking about risks incurred as a result of an action. This is because there is always some amount of uncertainty.

Uncertainty – A lack of knowledge about factors that may affect the outcome of an action.

Risk – The probability that something bad will happen as the result of an action.

Hazard – A measure of the severity of a harmful effect or event.

Exposure – An individual or group's contact with an environmental contaminant. This contact includes ingestion (eating and drinking), inhalation (breathing), and skin contact.

Dose – The amount of a contaminant that enters the body.

Toxicity – A measure of the ability of a substance to cause adverse health effects.

The risk of suffering an adverse health effect from exposure to an environmental contaminant depends on the exposure, the toxicity of the contaminant, the dose of the contaminant you are exposed to, and personal characteristics. Risk assessors, health assessors, and toxicologists communicate risks in terms of numbers (quantitatively). Below is a probability table displaying how risk can be communicated quantitatively.

Wording	Fraction	Decimal	Percent	Scientific Notation
One in ten chance	1/10	0.1	10%	1×10^{-1}
One in one hundred chance	1/100	0.01	1%	1×10^{-2}
One in one thousand chance	1/1,000	0.001	0.1%	1×10^{-3}
One in ten thousand chance	1/10,000	0.0001	0.01%	1×10^{-4}
One in one hundred thousand chance	1/100,000	0.00001	0.001%	1×10^{-5}
One in a million chance	1/1,000,000	0.000001	0.0001%	1×10^{-6}

In reality, people often do not view risk quantitatively. Often people associate risk with an action depending upon their perceptions. There are many factors which influence how people perceive risk. The following factors often influence the public's perception of risk:

Involuntary versus Voluntary – Most people would not like to be forced to jump off a bridge. However, others pay for the privilege of jumping off bridges when they go "bungee jumping." The first risk would be *involuntary*, while the second is clearly *voluntary*. If there is a choice in the matter, many people perceive an action as having less risk.

Uncontrollable versus Controllable – When people are not in control of an action (chlorination of drinking water), they tend to think the action carries greater risk. However, when they are in control of an action (using a chemical water softening system in their home) they tend to think the action carries less risk.

Natural versus Industrial – Natural risks (hiking on Mt. St. Helens) tend to be viewed as more acceptable than industrial risks (walking next to an oil refinery).

Unfamiliar versus Familiar – People drive cars every day but are extremely fearful of living anywhere near a nuclear reactor even though car accidents kill thousands annually while nuclear reactor accidents have resulted in only 3 deaths in North America.

Uncertain versus Certain – People view a proven health hazard like tobacco as less risky than other less well known chemicals such as dioxin. Tobacco has proven health effects whereas the health effects of dioxin have yet to be fully understood by scientists.

Catastrophic versus Ordinary – Flying in a jet airplane is much less risky than driving in a car. Yet the perception is that flying is more dangerous because when a jet crashes it is a much more catastrophic event in terms of damage and lives lost in a single event.

Fair versus Unfair – People in lower socioeconomic communities who face health risks more than those in more affluent neighborhoods often feel a sense of outrage against the source of the risk, especially if there is no direct benefit to their community from the risk in question. Risk without benefit is seen as unfair.

Untrustworthy versus Trustworthy – A person generally doesn't think twice about drinking water from their tap. However, how would that person feel about drinking a cup of water taken from an open, common well in the middle of a town in a third world country?